

# Exhibit 4.4

**Samsung – Soundbar**

(See Accused Product List at end of chart for soundbar models)

**Infringement of the '430 patent****Claim #2**

2. A speaker system for producing localized regions of sound comprising:

**Evidence**

The Samsung soundbar is a speaker system for producing localized regions of sound.

For example, the soundbar produces a surround sound effect. The surround sound effect causes a listener facing the soundbar to perceive that sound emanating from the soundbar is originating at a location behind and to the left of the listener, referred to as surround left, and at another location behind and to the right of the listener, referred to as surround right.

### **Q-Series Soundbar and TV, orchestrated in perfect harmony**

#### **Q-Symphony**

This soundbar syncs with your Samsung TV, together creating immersive sound. It combines and enhances sound through the soundbar's front, side, and up-firing speakers as well as the TV's speakers, giving you the ultimate sound synergy.

[3]

### **S-Series Soundbar**

#### **Compact soundbar with room-filling surround sound**

Samsung's S-Series Soundbar is a brilliant compact soundbar that fills your space with sound from anywhere in the room. The built-in center speaker smartly delivers crystal clear sound so you don't miss dialogue from your favourite show to noise and distractions.

[3]

## B-Series Soundbar

**Elevate your sound experience with powerful bass**

With the B-Series Soundbar, you can discover a richer & deeper 3D surround sound experience. Experience more dramatic impact and enhanced sensation with the wireless subwoofer and built-in extra bass boost. If you want to add more bass, just turn on Bass Mode and it will deliver a more powerful dynamism to your viewing experience.

[3]

a multiplicity of audio frequency speakers;

The Samsung soundbar includes a multiplicity of audio frequency speakers.

For example, the soundbar includes multiple audio speakers positioned along a front face of the soundbar.



[3]

at least one defined sound target spaced from each of the speakers of the multiplicity of speakers,

The Samsung soundbar has at least one defined sound target spaced from each of the speakers of the multiplicity of speakers. Each speaker has a means for applying a time varying audio drive

wherein each speaker has a means for applying a time varying audio drive voltage which is substantially identical, except that each audio drive voltage is offset in time by an amount which is related to the distance between each speaker and the defined sound target, so that substantially identical sound from each speaker reaches the sound target at the same time;

voltage which is substantially identical, except that each audio drive voltage is offset in time by an amount which is related to the distance between each speaker and the defined sound target. So that substantially identical sound from each speaker reaches the sound target at the same time.

For example, each of the speakers is connected to an audio amplifier. A surround left channel signal is provided to each speaker via the speaker's respective amplifier. The surround left channel is delayed slightly for speakers on the listener's left compared to speakers on the listener's right. The amount of delay is such that sound waves emanating from each of the speakers reaches the surround left location at the same time, thereby interfering constructively to produce a resultant sound wave having a peak spatial amplitude at the surround left location. When this wave reflects back to the listener, the listener perceives that the sound originated from the surround left location. [A]



## Sound modes

The HW-Q800A comes with four main sound modes: Standard, Surround, Game Pro, and Adaptive. The Standard mode is akin to the “Direct” mode on other soundbars, meaning that 2.0-channel audio sources aren’t upmixed to full-on 3.1.2-channel sound. The Surround mode *does* upmix everything, including stereo sources, to 3.1.2 sound.

[2]

The main soundbar unit has a total of seven drivers, including a pair of woofers and two tweeters that are split between the left and right channels, plus a wide-range tweeter for the center channel. Two more upfiring drivers (which use Samsung’s horn-style Acoustic Beam technology) bounce sound off the ceiling for the height cues of object-based Dolby Atmos and DTS:X soundtracks, an easier and cheaper alternative to installing actual height speakers in your ceiling. All seven of those drivers are powered by a quartet of Class D amplifiers, while a fifth Class D amp is dedicated to the 8-inch driver in the wireless subwoofer.

[2]

**According to the specification the term: “substantially identical” means:**

“It should be understood that when, a means for applying a time varying audio drive voltage, i.e. the signal used to drive individual speakers is described as substantially identical, the signals are defined as being substantially identical, although they vary in amplitude. The term, substantially identical, means capable of constructive interference when used in the sound system **36** of this invention.” [col.12 lines 18-24]

at least a first defined sound target and a second defined sound target, the second sound target being spaced from the first sound target, and the first sound target and the second sound target being spaced from each of the speakers of the multiplicity of speakers,

The Samsung soundbar has at least a first defined sound target and a second defined sound target. The second sound target is spaced from the first sound target. The first sound target and the second sound target are spaced from each of the speakers.

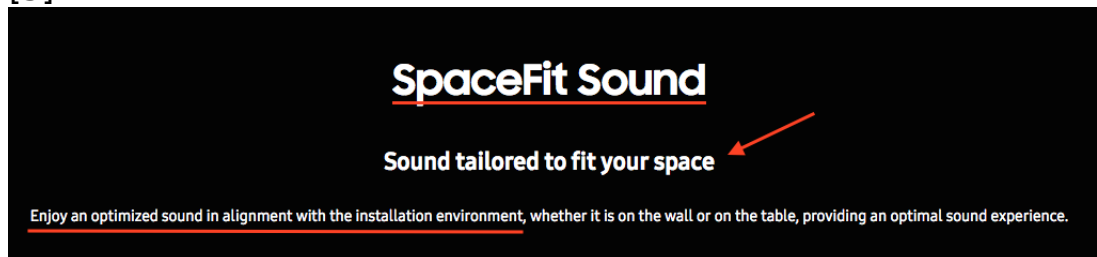
For example, the surround left location is at a rear position on a left-side wall of a nominally sized room e.g. 10 ft x 15 ft. The surround right location is at a rear position on the right-side wall of the room. Additionally, the SpaceFit feature enables the soundbar to adapt to the dimensions of the room.

## Q-Series Soundbar

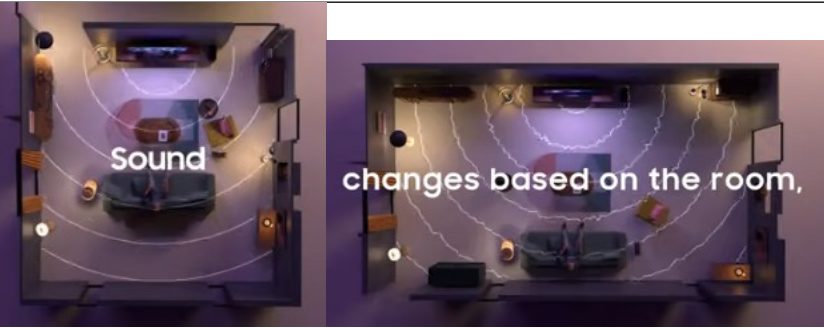
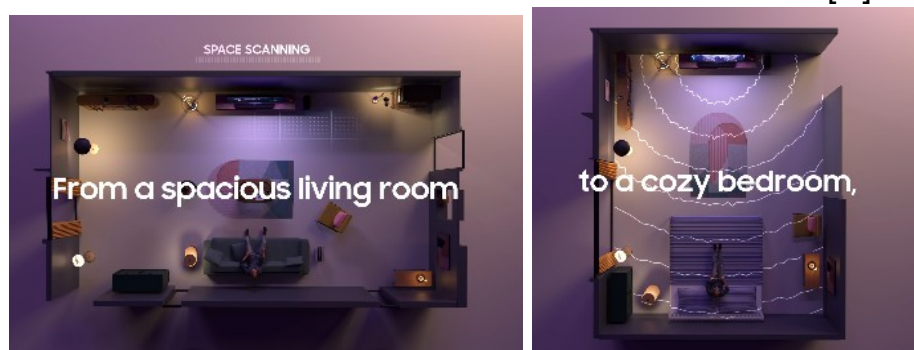
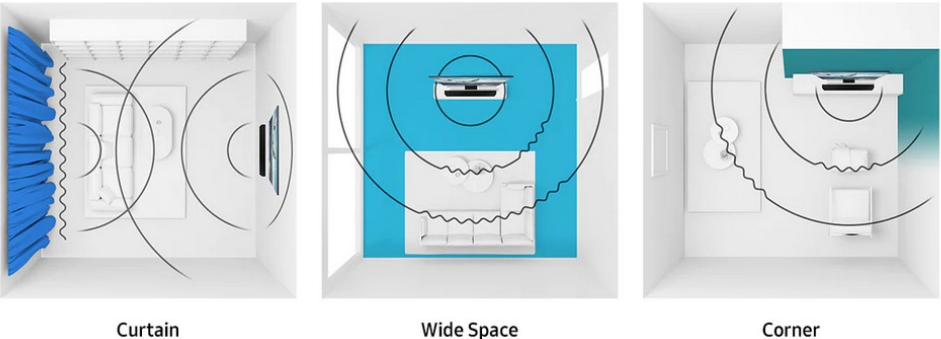
### Perfectly crafted sound, harmonized with QLED

Enjoy the Dolby Atmos experience wirelessly with Samsung's Q-Series Soundbar. To ensure an extraordinary sound quality of your content, Q-Symphony enables the perfect harmony between the TV and the soundbar. SpaceFit Sound smartly reads the room and calibrates sound for your space to perfection regardless of what you watch.

[3]



[3]

	  
<p>and wherein the means for applying a time varying audio drive voltage comprises:  at least a first audio source which is offset in time by an amount which is related to the distance between each speaker and the first defined sound target; and</p>	<p>The means for applying a time varying audio drive voltage comprises at least a first audio source which is offset in time by an amount which is related to the distance between each speaker and the first defined sound target.</p> <p>For example, a delay is added to the surround left channel (e.g. first audio source) before it is applied to a speaker on the left-side of the soundbar, as viewed from the listener's position. The delay relates</p>



	<p>to the distance between the speaker and the surround left location in the nominally sized room, whereby the speaker closest to the surround left location has the most delay. This enables the soundbar to produce directional audio. [A]</p> <p><u>Game Pro Mode is optimized to deliver “3D directional audio”</u> for gamers, while Adaptive Sound mode analyzes the sound and intelligently optimizes it depending on what you’re watching or listening to. Adaptive Sound mode also boosts the dialogue, while both Adaptive Sound and Game Pro mode upmix all audio sources to 3.1.2-channel sound.</p> <p>[2]</p>
<p>at least a second audio source which is offset in time by an amount which is related to the distance between each speaker and the second defined sound target wherein a sum of the first audio source which is offset in time and the second audio source which is offset in time is used to produce the time varying audio drive voltage so that substantially identical sound from the first audio source signal reaches the first sound target at the same time, and substantially identical sound from the second audio source signal reaches the second target at the same time.</p>	<p>The Samsung soundbar includes at least a second audio source which is offset in time by an amount which is related to the distance between each speaker and the second defined sound target. The sum of the first audio source and the second audio source is used to produce the time varying audio drive voltage. Substantially identical sound from the first audio source signal reaches the first sound target at the same time, and substantially identical sound from the second audio source signal reaches the second target at the same time.</p> <p>For example, a delay is added to the surround right channel (e.g. second audio source) before it is applied to a speaker on the right-side of the soundbar. The delay relates to the distance between the speaker and the surround right location, whereby the speaker closest to the surround right location has the most delay. Each speaker is provided, via its amplifier, with a surround left channel signal and a surround right channel signal, each signal having a respective delay. The signals are added together before being input to the respective amplifier. Consequently, each speaker emits a sound wave comprising audio from the surround left channel and from the surround right channel, the audio from each channel having an appropriate amount of delay such that the surround left audio reaches the surround left location at the same time as the</p>



surround right audio reaches the surround right location. [A]

2022 Soundbars Q-SERIES SOUNDBAR ULTRA SLIM SOUNDBAR S-SERIES SOUNDBAR B-SERIES SOUNDBAR

See all



[3]

**Samsung – HW-Q800 soundbar**  
(See Accused Product List at end of chart for soundbar)

**Infringement of the ‘430 patent**

Claim #3	Evidence
3. A speaker system for producing localized regions of sound comprising:	<p>The Samsung soundbar is speaker a system for producing localized regions of sound.</p> <p>For example, the soundbar produces a surround sound effect. The surround sound effect causes a listener facing the soundbar to perceive that sound emanating from the soundbar is originating at a</p>

	<p>location behind and to the left of the listener, referred to as surround left, and at another location behind and to the right of the listener, referred to as surround right.</p> <p>Sound modes</p> <p><u>The HW-Q800A comes with four main sound modes: Standard, Surround, Game Pro, and Adaptive.</u> The Standard mode is akin to the “Direct” mode on other soundbars, meaning that 2.0-channel audio sources aren’t upmixed to full-on 3.1.2-channel sound. <u>The Surround mode does upmix everything, including stereo sources, to 3.1.2 sound.</u></p> <p>[2]</p>
a multiplicity of audio frequency speakers;	<p>The Samsung soundbar includes a multiplicity of audio frequency speakers.</p> <p>For example, the soundbar includes five audio speakers positioned along a front face of the soundbar and two audio speakers facing upwards.</p> <p><u>The main soundbar unit has a total of seven drivers,</u> including a pair of woofers and two tweeters that are split between the left and right channels, plus a wide-range tweeter for the center channel. Two more upfiring drivers (which use Samsung’s horn-style Acoustic Beam technology) bounce sound off the ceiling for the height cues of object-based Dolby Atmos and DTS:X soundtracks, an easier and cheaper alternative to installing actual height speakers in your ceiling. All seven of those drivers are powered by a quartet of Class D amplifiers, while a fifth Class D amp is dedicated to the 8-inch driver in the wireless subwoofer.</p> <p>[2]</p>
at least one defined sound target spaced from each of the speakers of the multiplicity of speakers, wherein each speaker has a means for applying a time varying audio drive voltage which is substantially identical, except that each audio drive voltage is offset	<p>The Samsung soundbar has at least one defined sound target spaced from each of the speakers of the multiplicity of speakers. Each speaker has a means for applying a time varying audio drive voltage which is substantially identical, except that each audio drive voltage is offset in time by an amount which is related to the distance between each speaker and the defined sound target. So that substantially identical sound from each speaker reaches the sound target at the same time.</p>

<p>in time by an amount which is related to the distance between each speaker and the defined sound target, so that substantially identical sound from each speaker reaches the sound target at the same time; and</p>	<p>For example, each of the speakers is connected to an audio amplifier. A surround left channel signal is provided to each speaker via the speaker's respective amplifier. The surround left channel is delayed slightly for speakers on the listener's left compared to speakers on the listener's right. The amount of delay is such that sound waves emanating from each of the speakers reaches the surround left location at the same time, thereby interfering constructively to produce a resultant sound wave having a peak spatial amplitude at the surround left location. When this wave reflects back to the listener, the listener perceives that the sound originated from the surround left location. [A]</p> <p><u>Game Pro Mode is optimized to deliver "3D directional audio" for gamers, while Adaptive Sound mode analyzes the sound and intelligently optimizes it depending on what you're watching or listening to. Adaptive Sound mode also boosts the dialogue, while both Adaptive Sound and Game Pro mode upmix all audio sources to 3.1.2-channel sound.</u></p> <p>[2]</p> <p><b><u>According to the specification the term: "substantially identical" means:</u></b></p> <p>"It should be understood that when, a means for applying a time varying audio drive voltage, i.e. the signal used to drive individual speakers is described as substantially identical, the signals are defined as being substantially identical, although they vary in amplitude. The term, substantially identical, means capable of constructive interference when used in the sound system 36 of this invention." [col.12 lines 18-24]</p>
<p>wherein the means for applying a time varying audio drive voltage includes a class D amplifier.</p>	<p>The means for applying a time varying audio drive voltage includes a class D amplifier.</p> <p>For example, each amplifier connected to a speaker is a class D audio amplifier.</p>

The main soundbar unit has a total of seven drivers, including a pair of woofers and two tweeters that are split between the left and right channels, plus a wide-range tweeter for the center channel. Two more upfiring drivers (which use Samsung's horn-style Acoustic Beam technology) bounce sound off the ceiling for the height cues of object-based Dolby Atmos and DTS:X soundtracks, an easier and cheaper alternative to installing actual height speakers in your ceiling. All seven of those drivers are powered by a quartet of Class D amplifiers, while a fifth Class D amp is dedicated to the 8-inch driver in the wireless subwoofer.

[2]

### Accused Product List

**Q series:** HW-Q990C, HW-Q950A, HW-Q930C, HW-Q900A, HW-Q800A, HW-Q800C, HW-Q700A, HW-Q700C, HW-Q67CB, HW-Q600A, HW-Q600B

**C series:** HW-C450/ZC, HW-C400

**B series:** HW-B650, HW-B550, HW-B450

**S series:** HW-S801B, HWS61B, HW-S50B

**T series:** HW-T415, HW-T400

### References

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[2] TechHive - Samsung HW-Q800 Review

<https://www.techhive.com/article/579482/samsung-hw-q800a-review.html>

[3] Samsung – Soundbar Overview

<https://www.samsung.com/ca/audio-devices/soundbar-overview/>

[4] Samsung – Q Series Soundbar

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**General Reference:**

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[C] Yamaha – An Evolutionary History of the YSP series

[https://usa.yamaha.com/products/contents/audio\\_visual/ysp10th/chapter04/index.html](https://usa.yamaha.com/products/contents/audio_visual/ysp10th/chapter04/index.html)

[D] Digital Smart Homes – Yamaha Digital Sound Projector

[http://www.digitalsmarthomes.com/products/yamahaysp/digital\\_sound\\_projector.html](http://www.digitalsmarthomes.com/products/yamahaysp/digital_sound_projector.html)

[E] Electronic Design - Soundbar Design from Start to Finish: Power Amplifiers, Power Supplies, And ESD Protection

<https://www.electronicdesign.com/technologies/analog/article/21795245/soundbar-design-from-start-to-finish-power-amplifiers-power-supplies-and-esd-protection>

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<https://www.ti.com/tool/TIDA-00089>

[G] Wikipedia – Class-D Amplifier

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